MYCOTAXON

Volume 109, pp. 469–475 *July–September 2009*

The North American *Leucopaxillus monticola* (*L. cerealis* complex) newly recorded from Italy

Alfredo Vizzini[1] & Marco Contu[2]

[1]*alfredo.vizzini@unito.it*
Dipartimento di Biologia Vegetale, Università di Torino
Viale Mattioli 25, 10125 Torino, Italy

[2] *marcocontu@interfree.it*
Via Traversa via Roma, 12 (I Gioielli 2) - 07026 Olbia, Sassari, Italy

Abstract — Collections of an interesting small whitish *Leucopaxillus*, found in Italian *Larix* forests, are described and illustrated. This taxon, well characterized by a small pileus with a sulcate margin, a polypore-like odour, and abundant filamentous cheilocystidia, is here described as a minor aberrant form of *L. monticola*. A discussion on its taxonomic position within *Leucopaxillus* and notes on closely related species are also added.

Key words — *Agaricales*, tricholomatoid clade, *Tricholomataceae*, taxonomy

Introduction

According to recent molecular studies, the genus *Leucopaxillus* Boursier clusters in the tricholomatoid clade sensu Matheny, where together with *Clitocybe* (Fr.) Staude, *Collybia* (Fr.) Staude, *Lepista* (Fr.) W.G. Sm., and *Tricholoma* (Fr.) Staude it forms the family *Tricholomataceae* s.s. (Moncalvo et al. 2002, Matheny et al. 2006). Within this genus, the complex of *L. cerealis* (Lasch) Singer 1962 [(= *L. albissimus* (Peck) Singer 1939 s.l., fide Singer 1986)] includes numerous taxa exhibiting whitish basidiomata that are often difficult to circumscribe because they have been recognized based mainly on basidioma stature, organoleptic features (context taste and odour), and subtle variations in microanatomy (i.e., pileipellis structure, sporal morphology and ornamentations, degree of the amyloid reaction, presence or absence of cheilocystidia). Given the lack of evidence from sequence data, it is presently difficult to make an informed choice between a splitting attitude, i.e. recognizing a number of micro-species (e.g. Bon 1991, Gulden 1992, Consiglio & Contu 2000) and a lumping one, i.e. regarding them as phenotypic variants of a single species (e.g. Singer & Smith 1943, Malençon & Bertault 1975, Ludwig 2001, Horak 2005, Bresinsky 2006, Christensen 2008). However, based on literature data and our personal

experience, we think that some taxa belonging in this complex are well delimited (e.g. *L. barbarus* (Maire) Kühner 1926, *L. paradoxus* (Costantin & L.M. Dufour) Boursier 1925).

While collecting fungal samples to study the biodiversity of the mycota of Val di Susa (Turin, Italy), we encountered three different collections of specimens of a small, white *Leucopaxillus* that proved difficult to identify to species. A search of the relevant literature (e.g. Singer & Smith 1943, 1948; Bon 1991, Noordeloos 1995) led us to assign the specimens to a form of *L. monticola*, a species described from North America under *Pinus ponderosa* Douglas ex C. Lawson (Singer & Smith 1948) and only recently reported also from Europe (France, Bon 1991). The aim of this paper is to provide a complete description of this rarely collected species along with a discussion on its closest allies, and to extend its geographic and host ranges.

Materials and methods

Macroscopic characters were examined on fresh material. The study of microanatomical features was carried out on dried material using a Leica DM 4500 B and an Olympus BX50 light microscope with magnifications up to 1000 x. Mounts were observed in 3% KOH, Congo red (10% ammonia solution) and Melzer's reagent. Measurements are based on the observation of 30 basidiospores from three basidiomata (apiculus not included). The following abbreviations were used: [X, Y, Z] indicating that measurements were made on X spores, in Y samples from Z collections; Q = the quotient of length and width of the spores; Qm = the mean value of Q values in all collections studied. All the material examined is preserved in TO (Erbario del Dipartimento di Biologia Vegetale, Università degli Studi di Torino, Italia). Herbarium abbreviations follow Holmgren & Holmgren (1998).

Taxonomy

Leucopaxillus monticola (Singer & A.H. Sm.) Bon, Doc. Mycol. 20(79): 58 (1990)

≡ *Leucopaxillus albissimus* var. *monticola* Singer & A.H. Sm., Mycologia 39: 730 (1948, "1947").

Selected descriptions: Singer & Smith (1948: 730-732); Bon (1991: 109-110).

Habit collybioid or ± clitocyboid (Fig. 1). Pileus (20–)25–40(–45) mm in diameter, convex, then applanate, with margin persistently involute, at first almost snow white (reminiscent of a *Clitocybe* sect. *Candicantes*) then with light ochraceous-yellow flushes, or spots, especially at disc, surface at first glazed, finely pruinose, then granulose, slightly cracked, finely ribbed at margin (like *Leucopaxillus amarus* (Alb. & Schwein.) Kühner 1928 or *Tricholoma fulvum* (Bull.) Bigeard & H. Guill. 1909). Lamellae fairly crowded, 5–6 mm broad,

Figure 1. *Leucopaxillus monticola*. Basidiomes. Scale bar = 10 mm.

with 1(–2) lamellulae between two contiguous lamellae, adnate to subdecurrent, horizontal, non-anastomosing, often with a thin, long tooth on the stipe, whitish, then with a pale yellowish-cream tinge. Stipe (10–)15–25(–30) × 5–8 mm, white, generally shorter than the pileus diameter, cylindrical, sometimes flaring in the upper part, solid, pruinose at apex, with abundant basal mycelium incorporating substrate particles and whitish rhizomorphs. Context up to 5–6 mm thick in the pileus, whitish, fragile in the pileus, with a pungent, aromatic odour, a mixture between *Tricholoma saponaceum* (Fr.) P. Kumm. 1871 and *T. sulphureum* (Bull.) P. Kumm. 1871, calling to mind also that of *Heterobasidion annosum* (Fr.) Bref. 1888 s.l. and *Fomitopsis pinicola* (Sw.) P. Karst. 1881, and a slightly bitterish aftertaste on chewing. Spore print white.

Spores [30, 3, 3], regularly ellipsoid, (6.5–)7–8 × 4.5–5.2(–5.8) µm, on average 7.64 × 4.91 µm, Q = (1.3–)1.4–1.7(–1.9), Qm = 1.57, hyaline, generally with an oil droplet, with an amyloid ornamentation of small scattered warts, but at times appearing smooth or almost smooth (Fig. 2a). Basidia (26–)30–40(–45) × 8–10(–12) µm, four-spored, clavate, clamped (Fig. 2b). Cheilocystidia (marginal cells) very abundant, colourless, 28–50 × 2–3(–5) µm, cylindrical, subclavate, fusiform, often nodulose or forked, occasionally multiseptate (Fig. 2c). Pileipellis a cutis of cylindrical hyphae, obscurely erect towards the centre, 4–10 µm wide, with epiparietal pigment. Hymenophoral trama regular, some hyphae with refractive content (thromboplerous hyphae). Clamp connections numerous.

Habitat: gregarious to subcaespitose, on *Larix decidua* Mill. litter, often together with *Leucopaxillus amarus*.

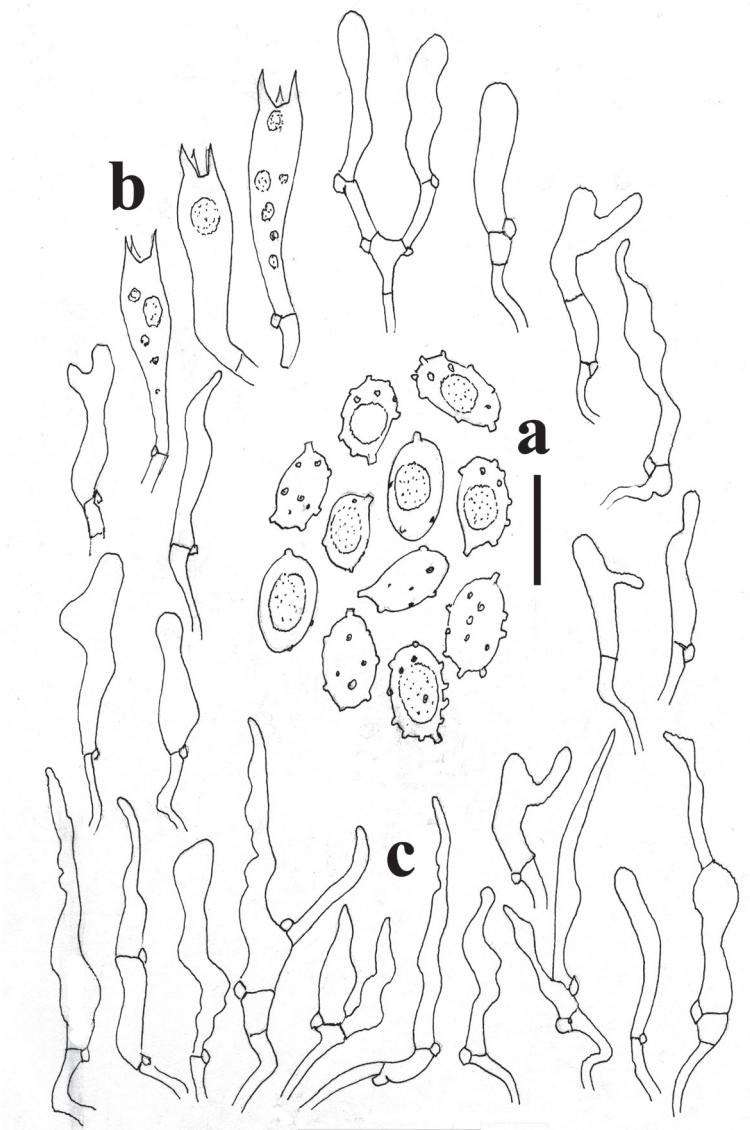

Figure 2. *Leucopaxillus monticola*. Micromorphologic characters of the basidiomes a. Spores. b. Basidia. c. Cheilocystidia. Scale bars: a,b = 10 µm; c = 30 µm.

Collection examined — ITALY, Le Toglie, Parco Orsiera Rocciavrè (Mattie, Turin), in a larch wood, 1600 m above sea level (a.s.l.), Sept. 20, 2008, leg. A. Vizzini (TO-HG1152); Bardonecchia (Turin), in a larch wood, 1312 m a.s.l., Sept. 10, 2001, leg. A. Vizzini (TO-HG1151); Colle del Frais (Chiomonte, Turin), in a mixed wood of larch and silver fir, 1500 m a.s.l., Sept. 3, 1999, leg. A. Vizzini (TO-HG1150).

Discussion

The micromorphological characters of these specimens, along with most of the macromorphological features, persuaded us to regard these collections as representing a peculiarly thin form of *Leucopaxillus monticola*. *Leucopaxillus monticola* is an American taxon originally proposed by Singer & Smith (1948) as a variety of *L. albissimus*. *Leucopaxillus albissimus* is now considered a synonym of *L. cerealis* (Singer 1986). *Leucopaxillus monticola* was subsequently rediscovered in Europe (France) also by Bon, who raised it to specific rank (Bon 1990). Our collections represent the third report of this taxon on world basis.

The similarities between the American and European collections – which we consider indisputably contaxic, with the consequence that the protologue by Singer & Smith (1948) is to be complemented with the description by Bon (1990) – are numerous as shown below.

1) From a macromorphological point of view, our fungus has (i) a dry, glabrous, opaque pileal surface, which later becomes areolate-rimose; (ii) colours white at margin and brownish-cream at disc; (iii) crowded, arcuate-subdecurrent lamellae; (iv) a clavate stipe, with fibrillose surface and abundant basal mycelium trapping a remarkable quantity of substrate; (v) a tough context with an aromatic odour tending to become disagreeable (like that of *Tricholoma album* (Schaeff.) P. Kumm. 1871 or *T. sulphureum*), with age, and taste that is initially sweetish or non-distinctive and with only a faint bitterish aftertaste.

2) From a micromorphological point of view, it shares with *L. monticola* (i) broadly ellipsoid spores not exceeding 8 µm in length and with an ornamentation that is hardly prominent or even barely visible in several spores [significantly, in the protologue of *Leucopaxillus albissimus* var. *monticola*, Singer & Smith (1948:130) wrote, "Spores 6.5–8 × 4.5–5 µm, broadly ellipsoid, strongly amyloid with small scattered warts (at times appearing almost smooth)"]; (ii) marginal cells abundant and variable in size and shape, at times even lobate (see Bon 1990: 110, who describes them, precisely, as "parfois attenueés à +/– lobés"); (iii) a pileipellis with confusedly erect hyphae.

Our specimens agree fairly well with the original description (Singer & Smith 1948) and with the French collection (Bon 1990, 1991) except for macroscopic and organoleptic features such as the distinctly smaller size, the ribbed margin of the pileus, adnate-subdecurrent lamellae, and smell with an unpleasant sulphureus component right from the start. We believe that these

discrepancies are not significant enough to suggest creating a new taxon at any rank and, in our opinion, they may mirror the intraspecific variability. To date this form seems to be known with certainty only from Italy, but probably present also in France (see René Chéreau's photograph as *L. cutefractus*, http://www.amo-nantes.com/galerie_de_photos_551.htm).

Leucopaxillus cutefractus Noordel. (Noordeloos 1984, 1995; = *L. paradoxus* sensu auct. neerl.; = *Leucopaxillus albissimus* var. *cutefractus* (Noordel.) E. Ludw. 2001), described on the basis of Dutch collections, most likely only an infraspecific variant of *L. paradoxus*, from which it is separated by the occurrence of distinct marginal cells, is a taxon very close to *L. monticola*. *L. cutefractus* has subsequently been collected in France (Courtecuisse 1993), Spain (Esteve-Raventós et al. 1995), Italy (e.g. Consiglio & Contu 2000, Brizzi 2007), Germany (Ludwig 2001, as *L. albissimus* var. *cutefractus*), Esthonia (Bresinsky 2006), Finland and Sweden (Christensen 2008). In any case, whatever its taxonomic rank, the latter differs from our fungus in the larger size of basidiomata (pileus 80–120 mm in diameter), the lamellae distinctly less crowded, more decurrent, much thicker and strongly anastomosing at the stipe insertion, as well as the broader spores (4.5–6.0(–6.5) µm) with a distinctly more prominent ornamentation; in addition, the context is odourless or its odour is just aromatic, not unpleasant, and the taste sweetish, certainly neither bitter nor disagreeable, and the habitat is different (tendency to grow on sandy, ruderal sites, under broadleaf trees).

Acknowledgments

We express our gratitude to Prof. Edmondo Grilli (Popoli, Pescara, Italy) for his valuable contribution. Our most sincere thanks are due to Prof. G. Moreno (Univ. Alcalá de Henares, Madrid, Spain) and to Prof. T. Baroni (State University of New York – College at Cortland, Cortland, USA) for their pre-submission reviews.

Literature cited

Bon M. 1990. Taxons nouveaux et validations. Doc. Mycol. 20(79): 57–62.

Bon M. 1991. *Tricholomataceae* (Fayod) Heim (1ère partie) (*Tricholomoideae* et *Leucopaxilloideae*). *Flore Mycologique d'Europe* Vol. 2. Les Tricholomes et Ressemblants. Doc. Mycol. Mémoire Hors Série. Amiens, 163 p.

Bresinsky A. 2006. Observations on mycobiota in Estonia. Folia Cryptogamica Estonica 42: 1–9.

Brizzi B. 2007. *Leucopaxillus cutefractus*. Bollettino del Gruppo Micologico Camaiorese 15: 50–54.

Christensen M. 2008. *Leucopaxillus* Boursier. In: Knudsen H, Vesterholt J (eds), Funga Nordica. Nordsvamp, Copenhagen, pp. 409–411.

Consiglio G, Contu M. 2000. Il genere *Leucopaxillus* Boursier in Italia, con brevi note sulle rimanenti specie europee. Bollettino della Associazione Micologica Ecologica Romana 51: 3–36.

Courtecuisse R. 1993. Macromycètes intéressants, rares ou nouveaux VII. Taxons nouveaux pour la France et autres récoltes remarquables. Doc. Mycol. 23(91): 1–12.

Esteve-Raventós F, González V, Moreno G, Arenal F.1995. Due specie rare di *Leucopaxillus*, *L. cutefractus* e *L. lepistoides* rinvenute in Spagna. Rivista di Micologia 38 (3): 273–278.

Gulden G. 1992. *Leucopaxillus* Bours. In: Hansen L, Knudsen H (eds), Nordic Macromycetes Vol. 2. Nordsvamp, Copenhagen, pp. 135–136.

Holmgren PK, Holmgren NH. 1998. (continuously updated). Index Herbariorum: A global directory of public herbaria and associated staff. New York Botanical Garden's Virtual Herbarium. http://sweetgum.nybg.org/ih/ (accessed 14 May. 2009).

Horak E. 2005. Röhrlinge und Blätterpilze in Europa. Spektrum, Elsevier, Heidelberg, 592 p.

Ludwig E. 2001. Die kleinen Gattungen der Makromyzeten mit lamelligem Hymenophor aus den Ordnungen *Agaricales*, *Boletales* und *Polyporales*. Pilzkompendium, Band 1, Beschreibungen. IHW-Verlag, Eching. 758 p.

Malençon G, Bertault R. 1975. Flore des Champignons supérieurs du Maroc. Tome II. Rabat, 540 p.

Matheny PB, Curtis JM, Hofstetter V, Aime MC, Moncalvo J-M, Ge Z-W, Yang Z-L, Slot JC, Ammirati JF, Baroni TJ, Bougher NL, Hughes KW, Lodge DJ, Kerrigan RW, Seidl MT, Aanen DK, DeNitis M, Daniele GM, Desjardin DE, Kropp BR, Norvell LL, Parker A, Vellinga EC, Vilgalys R, Hibbett DS. 2006. Major clades of *Agaricales*: a multilocus phylogenetic overview. Mycologia 98: 982–995.

Moncalvo JM, Vilgalys R, Redhead SA, Johnson JE, James TY, Aime MC, Hofstetter V, Verduin SJW, Larsson E, Baroni TJ, Thorn RG, Jacobsson S, Clemençon H, Miller OK. 2002. One hundred and seventeen clades of euagarics. Mol. Phylogenet. Evol. 23 (3): 357–400.

Noordeloos ME. 1984. Notulae ad Floram Agaricinam Neerlandicam. IV–V. *Clitopilus* and *Leucopaxillus*. Persoonia 12(2): 155–167.

Noordeloos EM. 1995. *Leucopaxillus*. In: Bas C, Kuyper ThW, Noordeloos ME, Vellinga EC (eds), Flora Agaricina Neerlandica, vol. 3. Balkema, Rotterdam, pp. 76–77.

Singer R. 1986. The Agaricales in Modern Taxonomy, 4° ed. Koeltz Scientific Books, Koenigstein, 981 p.

Singer R, Smith AH. 1943. A monograph on the genus *Leucopaxillus* Boursier. Papers of the Michigan Academy of Science, Arts & Letters 28: 85–132.

Singer R, Smith AH. 1948 ("1947"). Additional notes on the genus *Leucopaxillus*. Mycologia 39: 725–736.